

2008

# Nutrition education material to address iron deficiency anemia in Kenya

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DOI: <https://doi.org/10.31979/etd.xdx7-hqmm>  
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NUTRITION EDUCATION MATERIAL TO ADDRESS IRON DEFICIENCY  
ANEMIA IN KENYA

A Thesis

Presented to

The Faculty of the Department of Nutrition, Food Science, and Packaging

San Jose State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

Patricia Kakunted

August 2008

UMI Number: 1459707

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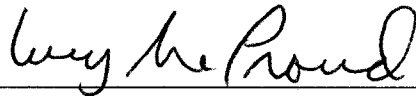
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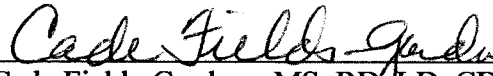
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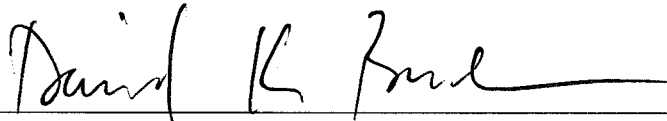
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## ABSTRACT

### NUTRITION EDUCATION ON IRON DEFICIENCY ANEMIA IN KENYA, AFRICA

by Patricia Kakunted

This study tested nutrition educational materials designed to improve the ability to identify indigenous food sources of heme and non-heme, vitamin C, as well as proper cooking methods to increase bioavailability of these nutrients, to assist in the treatment of iron deficiency anemia in Kenya, Africa. Pre/posttest questionnaires were used to assess change in knowledge among 80 participants including patients with HIV/AIDS, community health care workers, and nurses from three communities in Kenya (Voi, Mombassa, and Nairobi). The result demonstrated that 80% of the participants had knowledge of iron-rich foods, 48% of vitamin C rich-foods, and 32% of proper cooking method to maximize iron absorption. Although individuals had knowledge of iron-rich food sources, they had considerable less information on sources of vitamin C and almost no knowledge of cooking methods. Nutrition education materials/sessions should focus more on vitamin C rich food sources and proper cooking methods to retain nutrients.

## ACKNOWLEDGMENTS

Sincere thanks to my academic committee: Clarie Hollenbeck, PhD.; Cade Fields-Gardner, MS, RD, LD, CD; and Lucy McProud, PhD., RD. Dr. Hollenbeck, thanks for all the advice, wisdom, encouragement, and support. I could not have accomplished this without your support. Dr. McProud, whose support and contribution to this thesis is very much appreciated. Cade Fields-Gardner, for contributing significantly to this project and to the Nutrition and Food Science Department at San Jose State University. Your patience and vision to make the world a better place will change many lives.

Thanks to my family for their infinite encouragement and understanding, especially Richard B. Gwananji for his endless support and love throughout my educational accomplishment. To Janet N. Gwananji, who inspired and instilled the values of education in me by placing herself as a good role model. Thanks to Judith N. King, whose unconditional support and love gave me so much encouragement. I thank my parents, especially my mother Fogam Najela Emerencia, who fought hard for my success. To all my friends: Dr. Nubia Kristen Kaba, Dr. Gabriel Asongwe, Dr. & Mrs. Martin Kwende, Dr. Charles Njinda, whose support and contribution towards my educational achievement will never be forgotten.

## PREFACE

The journal article was written and formatted according to the publication guidelines outlined by the *Journal of the American Dietetic Association*. The remainder of the project was written according to the publication manual of the *American Psychological Association* 5<sup>th</sup> edition, 2001.



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CHAPTER I  
INTRODUCTION AND REVIEW OF THE LITERATURE

## Introduction

According to the WHO (2006), iron deficiency (ID) and iron deficiency anemia (IDA) remain the most common nutritional disorders, affecting about two million people. ID and IDA are highly prevalent in sub-Saharan Africa; while affecting both genders, IDA is much more common in women of childbearing age and children (World Health Organization, 2006). Infection with the human immunodeficiency virus (HIV) and its symptomatic manifestation as acquired immunodeficiency syndrome (AIDS) present a challenge in diagnosis and treatment of ID and IDA in a setting where anemia is common. Although general recommendations have suggested that iron supplementation is appropriate in cases of IDA, the overlay of HIV infection complicates therapeutic use of iron supplements. HIV infection is a life-long inflammatory and immunosuppressive condition associated with altered iron metabolism secondary to oxidative stress, causing iron to be less available to the body (Butensky, Kennedy, Lee, & Harmatz, 2004). According to Mitsuyasu (1999), a major cause of anemia in HIV-infected patients is impaired erythropoiesis, infiltrative diseases of the bone marrow (such as mycobacterium avium complex) infection with B19 parvovirus, and nutritional deficiency.

Recent research has argued that iron supplementation could be detrimental, leading to accelerated disease progression in HIV-infected patients. Oppenheimer (2001), cautioned against supplementing iron, especially in those areas with potentially compromised immunity like HIV carriers, primigravidae, young infants, and those with malaria. Savarino, Pescarmona, & Boelaert (1999) suggested that unless a true iron deficiency state is demonstrated, no supplemental should be administered to HIV-

positive patients. As a result of the controversies regarding iron supplementation in HIV/AIDS patients, alternative ways of improving iron status through food-based iron intake may be the safest option for the prevention and treatment of IDA in this population.

In view of potential adverse effects of iron supplementation as well as other treatment methods discussed in the review of literature, it is important to educate at risk population on indigenous good sources of key nutrients, as well as proper cooking methods to increase and retain nutrient bioavailability

The purpose of this study was to determine knowledge change from baseline after nutrition education intervention on indigenous foods rich in iron, vitamin C as well as, food preparation to preserve vitamin C which enhance bioavailability of iron.

## Review of the Literature

### *Iron Deficiency and Iron Deficiency Anemia*

Recent statistics from the World Health Organization (WHO, 2006) indicates that two billion people, over 30% of the world's population, are anemic, much of this due to IDA. Iron deficiency (ID) prevents the bone marrow from producing enough hemoglobin for the red cells, resulting in smaller red blood cells that have a reduced oxygen carrying capacity. Microcytic, hypochromic anemia is one of the most common and widespread nutritional disorders globally, affecting large numbers of women, infants (especially premature or low-birth-weight infants), and children and adolescents (especially females) in resource-limited areas.

Iron deficiency anemia (IDA) may result from insufficient iron in the diet, iron malabsorption, blood loss, pregnancy, and abnormal presence of free hemoglobin in the urine (Komaroff, 1999; Cooper, 1996). The prevalence of IDAs among adolescent schoolgirls in western Kenya was found to be between 19.8 % [(ferritin < 12µg) and 30.4 % (ferritin <12µg + Hb < 120g/L)] depending on defining characteristics (Leestra et al., 2004). In Cote d'Ivoire, IDA accounted for about 50% of the anemia in schoolchildren and women, and 80% in preschool children 2-5 years old (WHO, 2004).

Adverse health effects of IDA are numerous and include poor pregnancy outcome, impaired physical and cognitive development, increased risk of morbidity in children, and reduced work productivity in adults (WHO, 2006). Impaired gastrointestinal function, altered patterns of hormone and metabolism, and reduced DNA replication and repair have also been noted as a consequence of IDA (WHO, 2001). Some researchers have demonstrated a correlation between iron status and depression, stress, and poor cognitive functioning in poor African mothers during the postpartum period (Beard et al, 2005; Corwin et al, 2003).

#### *Global Statistics on HIV/AIDS*

According to the Joint United Nations Programme on HIV/AIDS (UNAIDS, 2005) a total of 40.3 million people, including 38 million adults and 2.3 million children under 15, are currently infected with HIV globally. Of the 38 million adults, 17.5 million (46%) are women. In 2005 an estimated 4.9 million people were newly infected and 3.1 million deaths were related to HIV. Of the total number of 40.3 million infected individuals, 25.8 million (more than 60%) are in sub-Saharan Africa. Since the 1980s,



HIV/AIDS has remained one of the most challenging and catastrophic diseases in the world (Onyancha & Ocholla, 2004). In 2004, Kenya had a total population of 32 million people with an estimated HIV prevalence rate of 6.7% (UNAIDS, 2004).

### *HIV and Anemia*

Presently, there is a widespread body of literature indicating interaction between IDA and HIV/AIDS. Anemia is prevalent amongst those individuals with HIV/AIDS-infection and is recognized as an independent risk factor for early mortality. (WHO, 2004; Totin, Ndugwa, Mmiro, & Perry, 2002). According to Moyle (2002), anemia of chronic disease, bone marrow infections, and neoplasms are primary causes of anemia in those infected with HIV/AIDS. Phillips & Groer, (2002), noted that the three main categories of anemia in HIV disease are anemia due to impaired red blood cell production, increased red blood cell destruction, and increased red blood cell loss, while all of the mechanisms of altered iron metabolism during HIV/AIDS infection are not clearly understood.

Butensky, Kennedy, Lee, & Harmatz, (2004), stated that altered iron metabolism influences HIV disease by triggering viral transcription through the generation of oxidative stress secondary to chemical reactions. Oxidative stress could enhance HIV replication in both the macrophages and bystander lymphocytes. The physiology of anemia in people with HIV could also be due to many factors, including opportunistic infections, opportunistic malignancies, medication, malabsorption of vitamins and trace elements, as well as other nutrients. Intrinsic immune mechanisms which may independently contribute to impaired erythropoiesis (Spivak, Barnes, Fuchs, & Quinn,

1989) have been suggested to play major role in the development of anemia in HIV disease (Coyle, 1997; Mitsuyasu, 1999). (Spivak, Barnes, Fuchs & Quinn, 1989) stated that, anemia may worsen with increase inflammatory cytokines (interleukin-1, interleukin-6, tumor necrosis factor and interferon), which have been shown to alter red blood cell formation in varying ways (in vitro). For instance, tumor necrosis factor- $\alpha$  has been shown to inhibit erythropoiesis *in vitro*, while interferon- $\gamma$  has been shown to suppress the formation of erythroid colony-forming units. According to Hambleton (1996), mycobacterium avium and parvovirus infection are highly associated in HIV, related anemia.

The prevalence of anemia in general in Africa is estimated to be 46% (WHO, 2001). As noted by some researchers, the prevalence of anemia among those with HIV infection is estimated at 70%-80% (O'Brien, Kupka, Msamanga, Saathoff, Hunter & Fawzi, 2005). Although anemia has been cited as an independent risk factor for HIV mortality independent of CD4 and viral load (Moyle, 2002), anemia is also associated with a more rapid decline in CD4 counts, measure as time to a 50% drop in CD4 count from baseline (O'Brien, 2005).

#### *Strategies for Treating Iron Deficiency (ID) and Iron Deficiency Anemia (IDA)*

A variety of treatments are currently being used in the treatment of ID and IDA, including iron supplementation, blood transfusion, antiretroviral therapy, and dietary intervention. However, some of these treatment methods are not without adverse effects, which could impact the health of those with IDA anemia, especially HIV-infected patients.

### *Blood Transfusion*

Blood transfusions have been used to correct low RBC count related to IDA. However, if the volume of blood administered to patients is insufficient, it does not correct the underlying cause of anemia. Zucker et al. (1994) noted the beneficial effects of blood transfusion among anemic women administered in the Siaya District hospital of Western Kenya; however, this report also suggested that blood transfusion in anemic women might not be sufficient to correct the underlying deficiency.

A study by Moor et al (2001) investigated the estimated risk of HIV transmission by blood transfusion in Kenya, and reported that the prevalence of HIV among the studied subjects was 6.4% (120 of 1877). Twenty-six HIV-infected individuals donated blood that was transfused to uninfected patients. The most prominent reasons noted were: poor record keeping and transcription errors, incapability of interpretation of results, pipetting errors and lack of a quality assurance program. It was therefore concluded that a high prevalence of HIV was due to poor laboratory practices. Moore et al. also stated that one fifth to one half of women and children admitted to the hospital might require a blood transfusion, and because there are no blood banks available, patients often have to rely on family members whose blood may or may not be infected as donors. As noted by O'Brien, Kupka, Msamanga, Saathoff, Hunter & Fawzi (2005), transfusion for treatment of anemia was associated with increased risk of death among patients with HIV and is discouraged in Tanzania due to the risk of other infections and/or other predominant HIV subtypes.

### *Iron Supplementation*

Iron supplementation is commonly used for the treatment of ID and IDA.

Recently, there has been a focus on iron supplementation and some researchers have argued that it could have adverse effects on HIV/AIDS-infected individuals by speeding up disease progression, enhancing oxidative stress and increasing mortality rate (Traore & Meyer, 2004). Traore & Meyer also suggested that, excess iron is detrimental to the host by promoting microbial growth and is beneficial to the pathogen because it serves as a nutrient, therefore, negatively influencing stress protein production and immune system function. A study looking at host cell responses as well as virus replication indicated that too much iron significantly assists viral infection. In contrast, Clark & Semba (2001) have argued that there is no relationship between HIV disease severity and iron status; however, they stated that more research is needed to determine if supplementing iron has any adverse effect on HIV disease progression.

Cunningham-Rundles, Giardina, Grady, Califano, McKenzie & De Sousa (2000), investigated the effect of transfused iron overload on immune response. They stated that, immune response could be affected by iron at several levels and that iron has specific effects on the adaptive as well as the innate immune systems. Iron deficiency prevents the development and expression of cytotoxic effectors T-lymphocytes function and is associated with reduced phagocytic activity toward some fungi, such as candida albicans (Cunningham et al., 2000). Conversely, excess iron promotes the formation of intracellular free radicals consequently causing oxidative damage and growth of

intracellular pathogens by reducing production of key cytokines and, inhibiting phagocytic functions.

### *Highly Active Antiretroviral Therapy (HAART)*

With the introduction of a combination of antiretroviral therapy known as HAART, there has been a remarkable improvement in disease management leading to a significant decrease in opportunistic infections. It has been suggested that HAART therapy might be protective against anemia or the correction of pre-existing anemia in HIV-infected patients (Berhane et al., 2004). To ascertain the impact of HAART on anemia and its impact on the relationship between anemia and survival in a large cohort of HIV-infected women, Berhane et al. (2004) showed that the use of HAART for as little as six months reduced the incidence of anemia. Moore & Forney (2002) further supported Berhane's findings by showing that the use of HAART is an effective treatment for anemia during HIV infection however; the authors noted that patients on HAART who continue to be anemic may need additional intervention.

### *Dietary Intervention*

The adverse effects of drug therapy, as well as the cumbersome process, and feasibility of blood transfusion in treating anemia in HIV-infected individuals (especially in resource-limited settings), have lead to the quest to research safer and less costly options.

Dietary intervention may be a safer and more feasible solution. This intervention requires nutrition education to improve knowledge and practices that support positive health outcomes. Nutrition education has the potential to improve both knowledge and

outcomes. For example, a cross-sectional survey to evaluate the efficacy of a nutrition education intervention program, on female caregivers of infants in the Northern Province in South Africa demonstrated a significant improvement in breast-feeding and infant feeding practices in rural areas (Ladzani, Steyn, & Nel, 2000). Another study that looked at community-based nutrition education for improving infant growth in rural Karnataka, resulted in a statistically significant improvement in increasing weight velocity for female infants in the intervention group compared to a control group. Also, infants were more likely to exhibit four positive feeding behaviors included frequency of meals, greater dietary diversity, and better food choices compared to a non-intervention group (Kilaru, Griffiths, Ganapathy, & Ghosh, 2005). As noted by Agble (1997) in a study on the effective program for improving nutrition in Ghana, it was demonstrated that maternal knowledge of basic nutrition improved in project communities compared to non-project communities. Findings in the integrated rural nutrition project in Kawambwa, Zambia also indicated that nutrition education programs have a significant, impact on knowledge and attitudes than activities that only aimed at increasing food availability (Friedrich, 1997).

Nutrition education therefore plays a vital role in improving knowledge leading to long-term beneficial health effects as supported by the above noted research. Nutrition education is therefore a viable, sustainable solution in resource-limited setting.

### *Research Questions and Hypothesis*

The primary research question is; to what extent will nutrition education materials, presented to three groups, including patients infected with HIV/AIDS, nurses

and community healthcare workers improve their ability to identify indigenous sources of heme and non-heme-iron, vitamin C, as well as institute proper cooking methods to increase the bioavailability of these nutrient? The hypothesis of this study is that nutrition education materials can be developed that will improve the ability of the participants, including community healthcare workers, nurses, and patients with HIV/AIDS, to identify indigenous foods rich in heme and non-heme-iron, vitamin C, and will improve their knowledge on appropriate food preparation techniques used to enhance bioavailability and preserve these nutrients in foods.

### *Objective*

The main objective of this study was to test the impact of nutrition education materials on knowledge improvement to identify heme and non-heme-iron, vitamin C-rich food sources, and proper cooking methods to increase both consumption and bioavailability of these nutrients.

### *Theoretical Perspective/Conceptual Framework*

A construct from the Health Belief Model was used in designing a nutrition education pamphlet used in the present study. This model assumes that cognitive factors influence an individual's decision to make and maintain a specific health behavior change (Bauer & Sokolik, 2002). The pamphlet was designed to increase awareness about nutritional intervention to correct anemia in patients with HIV/AIDS by using indigenous Kenyan foods, and to educate individuals on how to efficiently incorporate food sources rich in iron and vitamin C into their diet. The targeted behavior change was for HIV/AIDS anemic patients to be able to identify and select iron and vitamin C rich food

sources on a daily basis in order to improve anemia status and decrease its adverse effect on general health.

There are five stages of changes used in this research includes, precontemplation, contemplation, preparation, action and maintenance. These pamphlets targeted those individuals in the preparation phase who believe that, the advantages of change are greater than the disadvantages and were committed to take action within the next 3 months. These participants may not be aware of iron deficiency anemia, nor foods to ingest in order to maintain healthy iron levels. Subjects in the contemplation phase were also targeted. These groups of subjects knows the importance of having normal iron levels and plan to take action in the next 6 months. They may also need reinforcement about what they already know and may need to learn more about how to increase iron in their diet. They need assistance in overcoming their ambivalence about making a dietary change. Therefore, the symptoms of anemia were provided to reinforce the negative aspects of not changing. Pictures were used to facilitate the participants in identifying foods containing iron and vitamin C and hopefully motivating change. The information was presented to reinforce what they already knew.

Individuals in the preparation phase were targeted by defining iron deficiency anemia and by listing the symptoms. Labeled pictures were used to educate the reader on foods that contain heme and non-heme iron and vitamin C. For those in the action phase of the model, this pamphlet was intended to reinforce changed behaviors and to refine their skills of incorporating iron foods into their daily diet. Reinforcement would be achieved by proving additional access to the information. To refine their skills,



information was provided about combining iron-rich foods with Vitamin C. Individuals in the maintenance phase would use this pamphlet to reinforce their knowledge. They can also test their knowledge by being able to correctly answer the questions provided (pre-test).

Finally, this pamphlet was intended to assist individuals in the decisional balance between the benefits and the costs of changing. If the reader can overcome the ambivalence to changing their behavior to incorporate adequate iron and vitamin C consumption, they are more likely to take action. To describe the drawbacks of not changing, the symptoms of anemia were provided. To assist in strengthening the benefits of changing, pictures were provided to make it seem easy to remember iron and vitamin C rich foods.

Constructs from the Health Belief Model and the Stages of Change Model were chosen due to the simplicity of addressing the phenomenon of changing over time. Dietary changes take time to occur and this model offers opportunities for individuals to select appropriate foods over time.

CHAPTER II  
JOURNAL ARTICLE

NUTRITION EDUCATION MATERIALS TO ADDRESS IRON DEFICIENCY  
ANEMIA IN KENYA

Research and Professional Brief

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## **ABSTRACT**

Iron deficiency and iron deficiency anemia, the most common nutritional deficiency in the world today, affects close to two million people. Anemia is an important prognostic marker for HIV disease progression. Drug therapies, blood transfusion, and dietary intervention use in the treatment of ID/IDA are not without adverse effects. This study was designed to test the impact of nutrition education materials on knowledge improvement in identifying heme and non-heme iron, vitamin C-rich foods, and proper cooking methods, which would increase both consumption and bioavailability of dietary iron in Nairobi, Mombasa, and Voi, Kenya. Eighty participants including 26 patients, 23 nurses, and 31 community health care workers (CHW) from urban and rural areas participated in the study. Results demonstrated that nurses, university graduates, females, and participants from urban areas had the greatest pre-existing knowledge. Nutrition education should focus on both practical and theoretical knowledge related to dietary intervention of ID/IDA.

## INTRODUCTION

Iron deficiency (ID) and iron deficiency anemia (IDA) are among the most prevalent and detrimental health problems in the world today (1,2). IDA affects close to two million people globally and is associated with impaired growth in children, poor pregnancy outcome; decrease work capacity in adults and many other adverse health, psychosocial, and economic effects (1,2). Anemia is an important prognostic marker for HIV disease progression (3), in turn, HIV can exacerbate anemia especially in advanced disease and in vulnerable populations (3).

Various treatment methods can and have been use in the treatment of ID and IDA including iron supplementation, blood transfusion, dietary intervention and drug therapies (4-11). However, these treatment methods are not without adverse effects (6, 7). For instance, iron supplementation can complicate HIV-infection by causing iron overload without solving the deficiency problem. Blood transfusion and drug therapies in resource-limited settings are less feasible because of cost constraints and lack of access or availability of necessary materials (7). In addition, safety of iron supplementation, drug therapies and transfusion may be limiting factors for these treatment options. Dietary intervention may be a safer and more feasible solution, but requires nutrition education to improve knowledge and practices to support positive health outcomes.

This pilot education project explored the ability of a nutrition education program to improve diet-related knowledge in patients, nurses and community health care workers (CHW) associated with HIV clinics in Kenya. Three topics were addressed in education sessions, including theoretical knowledge of food sources of iron and vitamin C and

practical application of knowledge and cooking methods to improve bioavailability of dietary iron.

## **METHODS**

Nutrition program coordinators for three AIDS relief programs in Kenya requested the development and pilot testing of nutrition education materials to address ID and IDA in three sites. Testing was planned to involve CHW, nurses and patients in Nairobi, Mombasa, and Voi. Nutrition program coordinators selected representatives from each group to participate in pre-pilot focus groups to determine topics and knowledge base on current practices related to dietary sources of iron. Focus group results were used to develop a teaching plan and educational materials. Nutrition program coordinators referred participants for enrollment in the education pilot study. The protocol was approved by the Institutional Review Board at San Jose State University and all participants provided informed consent. Local personnel were trained to implement the education sessions in the local language. Pre and post-test questionnaires were used to assess existing knowledge and knowledge gain. After the patient groups were tested, questionnaire wording was clarified to improve knowledge evaluation. The results were analyzed for frequencies and means for all participants within each demographic category were determined using SPSS version 11.0 Macintosh (SPSS Inc, Chicago, IL).

## **RESULTS AND DISCUSSION**

Eighty participants were enrolled in the pilot study. All completed responses were included in the evaluation and are shown in Table 1. The mean age was  $42.5 \pm 9.8$

years (range 24-67). Groups included 23 (33%) patients, 31 (39%) CHW, and nurses 22 (28%). Most of the participants had at least secondary education with nearly a third at university level. Over half (38 of 77, 52%) were from Nairobi (urban area) while approximately an equal number of the remaining participants were from an suburban area (18 of 77, 23% from Mombasa) and a rural area (21 of 77, 25% from Voi).

Nurses demonstrated the greatest pre-existing knowledge, while CHW and patients exhibited less pre-existing knowledge. Ninety-one percent of those with university education had pre-existing knowledge while participants with only primary education demonstrated the least knowledge on iron-rich food sources. Most nurses, 20 of 22 (91%), and half of CHW 14 of 31 (45%), had pre-existing knowledge on good indigenous food sources of iron. About half of the nurses had pre-existing knowledge on vitamin C food sources. Women demonstrated more knowledge on iron food sources than men. Cooking methods showed the least pre-existing knowledge in all groups. Urban participants in Nairobi had the greatest pre-existing knowledge on all topics.

Improvement in knowledge was demonstrated by an improvement in responses to test questions. Increase in knowledge was demonstrated by CHW on iron and vitamin C food sources. One third of patients gained knowledge on iron and vitamin C food sources. More than 40% of those with secondary school education exhibited an improvement in knowledge on iron and vitamin C-rich foods. There was a gain in knowledge on cooking methods among nurses, those with university education, participants from Nairobi and women. However, the knowledge gained by other groups appeared to be limited for cooking methods. Participants with less education performed

poorly on all topics. Urban areas participants demonstrated greater increase in knowledge than those from rural areas.

The pre-existing knowledge was high on dietary items related to anemia, mostly with iron and vitamin C-containing food resources but not in cooking methods to improve iron intake and bioavailability. Individuals with a higher education level, nurses, and individuals living in urban areas seemed to be more knowledgeable primarily on theoretical topics. These participants may have had greater educational opportunity and exposure to educational materials compared to those from rural areas with less formal education.

An increase in knowledge appeared to be highest in those with formal education. This may suggest that participants with higher education might have more experience with a formal education process. Participants with less formal education did not improve theoretical knowledge, which may reflect the lack of experience with a formal education process.

Participants with a higher level of education seemed to perform better with practical knowledge, which may suggest that they had a better conceptual knowledge to translate theory to practical application. Women improved more on the topic of cooking methods than men, which could be due to more extensive experience in cooking methods. Participants from urban areas demonstrated better knowledge than those from rural areas, which may result from the fact that they have more health care access and information compared to those in rural areas.



### *Limitations*

There are several limitations to the study. Selection of the participants was by invitation of the nutrition program coordinators and may not be representative of a wider population served by the AIDS relief clinics. The sample size may not be adequate to provide a representative sample of the populations served by AIDS relief programs in Kenya; however, one strength is that the study was based on samples from rural, suburban, and urban areas of Kenya. Finally, after patient sessions, the pre and post-test questionnaires wording was clarified. Thus, patient group results might have been better if retested with the clarified wording.

### **CONCLUSION**

The results suggest that there is a need for nutrition education to focus on both practical application and theoretical knowledge related to dietary intervention for ID and IDA. It also suggests that nutrition education should be carefully tailored in rural areas and those with less formal education. Effective nutrition education should include increased concentration on practical application and may require several sessions to achieve satisfactory results. Nutrition education reinforcement and monitoring of adequacy of knowledge to support behavior change and improve outcomes should be ongoing.

Nutrition education has been shown to improve knowledge (12-14). This research project showed that there are some topics that may require more focus, such as cooking methods. It is important to tailor educational materials and teaching methods according to the level of existing knowledge. It will also be important to reinforce existing

knowledge. Future research in this area should build on this research to determine the ability of nutrition education on dietary strategies to reduce ID and IDA to change behavior and health outcomes. Research should be focused on follow-up monitoring for nutrition education to determine its effect on health outcomes. Finally, there is a need to research the cost, benefits and safety of dietary interventions and provide comparisons to other treatment options in HIV-infected populations and for AIDS relief programs.

#### **ACKNOWLEDGEMENTS**

This research was supported by TCE consulting through their financial donation to a small garden project in Kenya. The author gratefully acknowledges the assistance of Brian Michino, Mary E. Schmitz, and Sr. Flora Augustin with subject recruitment and data collection. Special thanks, to the men and women who participated in this study for their generous cooperation.

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Table 1: Gain in participants' knowledge on the ability to identify indigenous sources of iron and vitamin C and proper cooking methods to increase bioavailability of these nutrients.<sup>1</sup>

Variables	Iron			Vitamin C			Cooking methods		
	PE	G	NG	PE	G	NG	PE	G	NG
<b>Total (n)</b>	<b>42</b>	<b>19</b>	<b>15</b>	<b>18</b>	<b>19</b>	<b>40</b>	<b>6</b>	<b>18</b>	<b>52</b>
<b>(%) of Total</b>	<b>55%</b>	<b>25%</b>	<b>20%</b>	<b>23%</b>	<b>25%</b>	<b>52%</b>	<b>8%</b>	<b>24%</b>	<b>68%</b>
<b>Sub-Group</b>									
Patients (n=23)	8	7	8	2	8	13	2	5	16
Healthcare Worker (n=31)	14	10	7	0	7	24	1	1	29
Nurses (n=22)	20	2	0	16	4	2	3	12	7

### ***Education***

No education (n=2)	2	0	0	0	1	1	0	1	1
Primary school (n=21)	7	5	9	2	2	17	0	2	19
Secondary school (n=29)	11	12	6	0	12	18	2	4	23
University (n=23)	21	2	0	16	3	4	3	11	9
Other (n=1)	1	0	0	0	1	0	1	0	0

### ***Site***

Voi (n=21)	9	3	8	0	6	14	1	2	17
Mombassa (n=18)	8	6	4	2	5	11	0	3	15
Nairobi (n=38)	25	10	3	16	8	15	5	13	20

### ***Gender***

Female (n=54)	33	11	10	14	13	27	2	12	40
Male (n=17)	7	6	4	4	5	9	4	5	8

<sup>1</sup>Pre-existing knowledge" (PE) was defined as choosing the correct answer on both pre and post-test; "Gain" (G) was defined as the selection of an incorrect answer on the pre-test followed by the selection of a correct answer on the post-test; "no gain (NG) was defined by the selection on an incorrect answer on both the pre-test and the post-test or selection of a correct answer on the pre-test followed by the selection of an incorrect answer on the post-test.

CHAPTER III  
SUMMARY AND RECOMMENDATIONS

## Summary and Recommendations

Organizations like WHO, UNAIDS, and UNICEF and considerable research have noted that ID/IDA greatly impacts the health status of both adults and children and poses numerous health risks such as poor pregnancy outcome, impaired physical and cognitive development, increased risk of morbidity in children and reduced work productivity in adults.

Anemia has also been suggested as a diagnostic marker for worsening HIV/AIDS disease and increasing risk for mortality (Belperio & Rhew, 2004). Various treatment methods have been used in the management of anemia including iron supplementation, blood transfusion, dietary intervention, and drug therapies. However, these treatment methods are not without adverse effects. Blood transfusion and drug therapies in resources limited setting are less feasible because of cost constraints and lack of access or availability of necessary materials. Therefore, dietary intervention may be a safer and more feasible solution. The purpose of this study was to explore the ability of a nutrition education program to improve diet-related knowledge in patients, nurses and community health care workers associated with HIV clinics in Kenya.

The results demonstrate that 80% of the participants exhibited preexisting knowledge on heme-iron food sources, 48% on vitamin C-rich food sources, and 32% on cooking methods to maximize iron absorption. Although, there was improvement of knowledge on these areas, the present research demonstrates an unequivocal need for future nutrition educational programs to focus on the identification of vitamin C-rich food, as well as, proper cooking methods especially designed to retain vitamin C which

helps to enhance non-heme iron absorption. Also, nutrition education materials should be tailored to improve knowledge in those with insufficient pre-existing knowledge and may require pre-testing to determine educational level.



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## APPENDIXES

## Appendix A

### Institutional Review Board Approval: San Jose State University

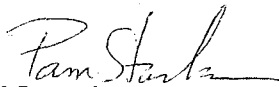


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To: Patricia Kakunted

From: Pam Stacks, AVP   
Graduate Studies & Research

Date: September 9, 2005

The Human Subjects-Institutional Review Board has approved your request to use human subjects in the study entitled:

“Testing Nutrition Education Materials Targeted to Anemia and Weaning Practices in Nairobi, Mombasa, and Voi in Kenya.”

This approval is contingent upon the subjects participating in your research project being appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity when they participate in your research project, and with regard to all data that may be collected from the subjects. The approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Pam Stacks, Ph.D. immediately. Injury includes but is not limited to bodily harm, psychological trauma, and release of potentially damaging personal information. This approval for the human subjects portion of your project is in effect for one year, and data collection beyond September 9, 2006 requires an extension request.

Please also be advised that all subjects need to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate, or withdrawal will not affect any services that the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact me at (408) 924-2480.

Cc: Dr. Clarie Hollenbeck

The California State University:  
Chancellor's Office  
Bakersfield, Chico, Dominguez Hills,  
Fresno, Fullerton, Hayward, Humboldt,  
Long Beach, Los Angeles, Maritime Academy,  
Monterey Bay, Northridge, Pomona,  
Sacramento, San Bernardino, San Diego,  
San Francisco, San José, San Luis Obispo,  
San Marcos, Sonoma, Stanislaus

## Appendix B

### Consent Form in Kiswahili

#### **Maafikiano kati ya washirika na Chuo Kikuu Cha San Jose katika Utafiti**

**JINA LA UTAFITI:** Jaribio la masomo ya Lishe ikizingatia Upungufu wa wekundu wa damu na jinsi mbalimbali Mwafaka za Ulishaji wa mtoto aliyewachishwa kunyonya, katika Miji ya Nairobi, Mombasa na Voi.

**UTANGULIZI:** Mimi, \_\_\_\_\_, ninakubali kuwa mshirika katika jitihada hii ya Jaribio la vifaa mbalimbali vya Masomo ya Lishe, ambao umetungwa kwa minajili ya mradi wa Dietetics and Small Garden systems. Ninafahamu ya kwamba jitihada hii imesimamiwa na Bw. Claire Hollenbeck, PhD, Mshauri wa Elimu ya Juu, Idara ya Lishe na Sayansi za Chakula, Chuo Kikuu Cha San Jose, akisadiana na Bi Cade Fields-Gardner, Mkurugenzi mkuu katika idara ya Lishe, mradi wa Dietetics and Small Garden Systems (wadamini wakiwa ni Chuo Kikuu cha Marquette) Amerika. Wataalamu wasaidizi wakiwemo wanafunzi, pia watashiriki katika jitihada hii. Nimeombwa kushiriki bila kulazimishwa kwa sababu, mimi hupokea huduma za afya mbalimbali kutoka kwa Eastern Deanery Aids Relief Program, aidha nitakuwa mmoja wa washirika hamsini.

**LENGO:** Lengo la utafiti huu ni kuongeza fahamu katika maswala nyeti ya Lishe ikiwemo Upungufu wa wekundu wa damu, na Jinsi mbalimbali Mwafaka za Ulishaji wa mtoto aliyewachishwa kunyonya.

**UTARATIBU:** Utaratibu wa utafiti huu ni kwamba, hapo mwanzo nitaulizwa maswali, kisha nitasoma juu ya mambo haya, kisha mwishowe nitaulizwa maswali. Sababu ya kufuata utaratibu huu ni kuweza kudhibitisha kana kwamba vifaa hivi ambavyo wamevitumia vimenieleleza zaidi kuhusu mambo haya muhimu ya Lishe. Maswali yatachukua dakika kumi na tano, na mafundisho yatachukua kadiri saa moja, kwa ujumla jitihada hii itachukua saa moja unusu.

**MASHAKA:** Nimeharifiwa ya kwamba hakuna hatari yeyote au mashaka nitakayo kumbana nayo katika jitihada hii.

**FAIDA:** Ninafahamu ya kwamba faida nitakazopokea kutokana na jitihada hii ni haswa elimu nyongeza juu ya Upungufu wa Wekundu wa damu, na Jinsi mbalimbali mwafaka za Ulishaji wa mtoto aliyewachishwa kunyonya. Aidha, mawazo yangu juu ya mambo haya yatatumia kwa manufaa ya wengine, ikiwa ni kwa madhumuni ya afya bora.

**MASHAKA YA KIFEDHA:** Ninafahamu ya kwamba hakuna malipo yeyote ambayo ninastahili au kutozwa, na mtu yeyote kwa kushiriki katika jitihada hii.

**SHAURI LA PILI:** Jinsi lingine ni kutoshiriki katika jitihada hii ya masomo na maswali haya.

**MCHUNGULIZI:** Mtafiti Msaidizi, \_\_\_\_\_ amenielezea kinagaubaga mambo juu ya jitihada hii ya utafiti, nimeelewa maelezo hayo, pia amekubali kujibu maswali yeyote nitakayo kuwa nayo juu ya jitihada hii.

SIRI: Nimefahamishwa ya kwamba habari zozote nitakazotoa na ambazo zinaambatana na jitihada za utafiti huu, na habari hizo huenda zikatambulika au kudhaniwa kuwa ni zangu, basi zitabaki kuwa siri. Jina langu halitatumikiwa au kuchapishwa katika nakala yeyote ya ripoti ya Utafiti huu. Lakini habari na vidokezo muhimu juu ya maswala haya nyeti ya Lishe, yaweza kuchapishwa katika nakala mbalimbali za ripoti hii. Ninafahamu ya kwamba baada ya muda wa mwaka mmoja, ikiwa habari hizi zitakoma kuwa na manufaa yeyote basi, makaratasi haya yatateketezwa kwenye moto na kuchomeka.

HAKUNA DHULUMA: Nimeharifiwa ya kwamba, kushiriki au kutoshiriki katika jitihada za utafiti huu, hautabadili uhusiano wangu na wanaonihudumia kiafya. Ushiriki wangu ni wa kujitolea bila kulipwa na nikohuru kuondoka au kujitenga na jitihada hii wakati wowote, bila kudhulumiwa na mtu yeyote au kikundi chochote.

FIDIA: Ninafahamu ya kwamba hakuna pesa au fidia zezote ninastahili kwa kushiriki katika jitihada hii ya utafiti.

HABARI ZAIDI: Ikiwa nitakuwa na maswali au tashwishi yeyote, kuhusu jitihada hizi za utafiti, ninafahamu nikohuru kuwasiliana na mmoja wa watu wafuatao: Bi, Alice Njoroge Mkurugenzi wa Utabibu, Eastern Deanery Aids Relief Programme, simu 020-780546, barua pepe [alicenjoroge@usa.net](mailto:alicenjoroge@usa.net); Mshauri wa Elimu ya Juu, Bw. Claire Hollenbeck, PhD, Idara ya Lishe na Sayansi Za Chakula, Chuo Kikuu cha San Jose Amerika, simu - +1-408-924-3100, barua pepe – [claireb@casa.sjsu.edu](mailto:claireb@casa.sjsu.edu). Aidha ninaweza kumuuliza muuguzi yeyote awasiliane na watu hawa kwa niaba yangu. Matatanishi yeyote ambayo nitakuwa nayo nitayawasilisha kwa Mwenyekiti Bi. Lucy Mcproud, PhD, RD, Idara ya Lishe na Sayansi za Chakula, Chuo Kikuu Cha San Jose, Amerika. Simu- +1-408-924-3100.

Isitoshe mawazo mengine juu ya haki zangu kama mshiriki yanapatikana kwenye Ofisi Ya Utafiti Elimu ya Juu, Chuo Kikuu Cha San Jose, Amerika.

Nikitia sahihi katika maafikiano haya, ninafahamu kuwa ushirika wangu ni wakujitolea bila malipo, na ninaweza kuondoka au kujitenga na jitihada hii ya utafiti wakati wowote bila kudhulumiwa na mtu, watu, au vikundi vyovyote vinavyoshirikiana na mradi huu. Nitapokea nakala ya maafikiano haya.

---

Sahihi ya mshiriki / Tarehe

---

Sahihi ya mshuhuda / Tarehe

Nimemwelezea kwa kinagaubaga, mshiriki huyu juu ya mawazo haya ya jitihada hii ya utafiti.

Wajumbe halali: Mary Schmitz au Brian Njoroge, Watafiti Wasaidizi, Dietetics and Small Garden Systems, Chuo Kikuu Cha Marquette.

---

Sahihi / Tarehe

## Appendix C

### Consent Form in English

#### **San Jose State University Agreement of Consent for Research Participants**

**Title:** Testing Nutrition Education Materials Targeted to Anemia and Weaning Practices in Nairobi, Mombasa, and Voi in Kenya

**INTRODUCTION:** I, \_\_\_\_\_, agree to be a part of the testing of educational materials developed for the Dietetics and Small Garden Systems project in Kenya. I understand that while the testing will be under the supervision of Clarie Hollenbeck, PhD, Graduate Advisor, Department of Nutrition and Food Science, San Jose State University and Cade Fields-Gardner, Nutrition Domain Coordinator, Dietetics and Small Gardens Systems, Marquette University in the United States, other professional people and students may be assigned to provide assistance. I was asked to be a part of the study because I am enrolled in the St. Joseph Shelter of Hope Program for health care in Voi and that I will be one of about 50 people who have been asked to participate.

**PURPOSE:** The purpose of the study is to better understand if nutrition education materials are able to improve knowledge of important nutrition issues, including anemia and child weaning practices.

**PROCEDURES:** I will be interviewed before and after the education session to learn how well the materials are able to improve knowledge on important nutrition topics. It is estimated that the interviews and educational sessions will take about one and a half hours, which includes fifteen (15) minutes for each of the interviews and one (1) hour for the education session.

**RISKS:** I have been informed that there are no anticipated risks or discomforts that I may reasonably expect as part of the study.

**BENEFITS:** I understand that the benefit to me is learning more about nutrition and anemia as well as nutrition and weaning practices. I understand that information, which is gathered about my knowledge before and after the education session may be useful to put together a program that could help people to eat better and improve their health.

**FINANCIAL RISKS:** I understand that there is no cost for being a part of the project.

**ALTERNATIVE PROCEDURES:** Another option is not to participate in the interviews and education session.

**ANSWER INQUIRIES:** Research assistant, \_\_\_\_\_ has explained the above items to me and I understand that explanation. (S)he has offered to answer my questions concerning the procedures involved in this project.

**CONFIDENTIALITY:** I have been informed that any information obtained from the interviews that can be identified with me will remain confidential. My name will not be used in any report or presentation on the results of the surveys that are done with me and others who have agreed to take part. The information may be reported so that it can be

useful to others. I understand that once the interviews are no longer of use it will be destroyed by shredding papers after one year.

NO PREJUDICE: I have been informed that my decision about whether or not to participate will not change my present or future relationship with any of the groups involved in this project, including the Voi St. Joseph Shelter of Hope or San Jose State University. I understand that participation is voluntary and that I am free to withdraw at any time without prejudice, and that withdrawal would not in any way change anything about services otherwise available to me. I understand that if I decide to stop being a part of the educational sessions and interviews, all information that was gathered will be destroyed by shredding.

COMPENSATION: I understand that I will not receive money or any other form of compensation for being a part of this project.

FUTHER INFORMATION: If I have further questions concerning this project at any time, I understand that I am free to communicate with Alice Njoroge at the Eastern Deanery Clinic in Nairobi at 020-780546 or at [alicenjoroge@usa.net](mailto:alicenjoroge@usa.net) who will be available to answer them. I can also ask for contact the local nurse to contact Alice Njoroge for me or contact the student advisor, Clarie Hollenbeck, PhD, Department of Nutrition and Food Science at San Jose State University at +1-408-924-3100 or at [clarieb@casa.sjsu.edu](mailto:clarieb@casa.sjsu.edu), who will be available to answer them. Complaints about the research may be presented to Lucy McProud, PhD, RD, Chair, Department of Nutrition and Food Science at San Jose State University at +1-408-924-3100. Additional information about my rights as a participant can be obtained from San Jose State University's Graduate Studies and Research at +1-408-924-7029 or [pstacks@email.sjsu.edu](mailto:pstacks@email.sjsu.edu).

By signing this agreement I understand that my participation is voluntary and that I am free to withdraw at any time without any negative effects or consequences from any of the agencies or groups who are involved with this project. I will receive a signed copy of this agreement for my records.

---

Signature of Participant or Authorized Representative / Date

---

Signature of Witness / Date

I have defined and fully explained the study as described herein to the subject.  
Authorized Representative: Mary Schmitz or Brian Njoroge, Research Assistants,  
Dietetics and Small Garden Systems, Marquette University

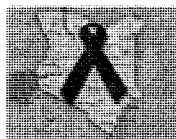
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Signature / Date

## Appendix D

### Letter of Collaboration from Marquette University

College of Nursing



Be The Difference.

Margaret Murphy, Ph.D., RN  
Director  
Training a Sustainable Health Care Workforce for  
AIDS Care and Counseling project  
and  
Dietetics and Small Gardens Systems to Support  
Antiretroviral Treatment project  
Phone: 414-288-3849/3853  
Fax: 414-288-1939  
E-mail: [margaret.murphy@marquette.edu](mailto:margaret.murphy@marquette.edu)

16 July 2005

Clarie Hollenbeck, PhD  
Department of Nutrition and Food Science  
San Jose State University  
One Washington Square  
San Jose, CA

Dear Dr. Hollenbeck,

This letter is to approve the participation of your graduate students, Patricia Kakunted and Begoña Cirera, to develop and test nutrition education materials in Kenya as a part of the efforts by Marquette University College of Nursing's Dietetics and Small Garden Systems (DSGS) project. The DSGS project has developed and implemented a nutrition care and treatment program with three HIV/AIDS community based program partners in Kenya, that are based in Voi, Mombasa and Nairobi. Nutrition-related education is a key component of our work.

The project will include the development and testing of nutrition education materials targeted to the staff and community of each of the AIDS Programs working with Marquette University's DSGS project. We will be working with the assigned project Regional Operations Facilitator, Ms. Mary Schmitz from Marquette University, and the In-Country Nutrition Team Leader, Mr. Brian Njoroge.

It is my understanding that this project will serve as their thesis project to satisfy requirements for your Master's degree in Nutritional Science through the Department of Nutrition and Food Science at San Jose State University. It is also my understanding that guidelines set forth for approval by the San Jose State University Institutional Review Board will be followed by you and the students and is agreed to by all involved in your project work.

Please feel free to contact me or to have others contact me if there is any further information you need regarding this project. Thank you for your willingness to share your expertise and time with your students and Marquette University College of Nursing to add this important aspect of a nutrition care and treatment program to our work in Kenya.

Best regards,

*Margaret Murphy, RN, PhD, Ph.D.*  
Margaret Murphy, RN, PhD, Director

Training a Sustainable Health Care Workforce for AIDS Care and Counseling Project and  
Dietetics and Small Gardens Systems to Support Antiretroviral Treatment for Families in Kenya Project  
Marquette University College of Nursing  
530 North 16th Street, P.O. Box 1881  
Milwaukee, WI 53201-1881 USA  
Phone: +1-414-288-3849/3853  
E-mail: [margaret.murphy@marquette.edu](mailto:margaret.murphy@marquette.edu)

Clark Hall, P.O. Box 1881, Milwaukee, Wisconsin 53201-1881



## Appendix E 1

### Pretest/Posttest Questionnaire for Nurses: English

Questions that were used to assess the knowledge of the nurses on indigenous Kenyan foods rich in heme and non-heme iron as well as vitamin C. Participants were asked to circle the correct answer(s).

1. What is the correct definition of Iron Deficiency Anemia?
  - a) When iron levels are too high in the blood
  - b) When iron levels are lower than the food you eat
  - c) When iron levels are below white blood cells
  - d) When iron levels are lower than normal in your body
2. What are good sources of iron?
  - a) Fish
  - b) Poultry
  - c) Red meat and beef liver
  - d) All of the above
3. Select a vegetable that contain iron
  - a) Spinach
  - b) Carrots
  - c) Brussels sprouts
  - d) Corn
4. Which one of the following grains is a good source of iron?
  - a) Bulrush millet
  - b) Wheat
  - c) Bread
  - d) Cabbage
5. Circle foods that will enhance iron absorption?
  - a) Cabbage
  - b) Liver
  - c) Spinach
  - d) Corn
6. Which of the following plant foods is the best source of iron?
  - a) Eggs
  - b) Cooked beans
  - c) Fish
  - d) Orange
7. Which of the following drink(s) is/are a good source of vitamin C?
  - a) Lemon juice and orange juice
  - b) Banana and watermelon
  - c) Coca cola and Fanta
  - d) Chai and Mandazi

8. What are other ways to preserve the iron during cooking?
  - a) Adding your green 2-3 minutes just before serving
  - b) Cooking lots of greens so that you can serve some the next day
  - c) Overcooking your greens so as to get the most iron.
  - d) Drinking four cups of milk daily
9. Which of these meals are good sources of iron?
  - a) Beef stew and Ugali
  - b) Sukumawiki and Ugali
  - c) Bread and butter
  - d) Cassava and Ugali
10. Which of the following food is a good source of iron?
  - a) Corn and beans
  - b) Beans cooked with tomatoes
  - c) Cabbage and Ugali
  - d) Corn and Ugali

## Appendix E 2

### Pretest/Posttest Questionnaire for Patients and Community Healthcare Workers: English

Questions that were used to assess the knowledge of the patients and community healthcare workers on indigenous Kenyan foods rich in heme and non-heme iron as well as vitamin C. Participants were asked to circle the correct answer(s).

- 1) What are good sources of iron?
  - a) Fish and poultry
  - b) Red meat Beef liver
  - c) All of the above
- 2) Select a vegetable that contain iron
  - a) Spinach
  - b) Carrots
  - c) Brussels sprouts
- 3) Which on of the following grains is a good source of iron?
  - a) Bulrush millet
  - b) Wheat
  - c) Bread
- 4) Circle foods that will enhance iron absorption?
  - a) Cabbaged
  - b) Pineapple
  - c) Mango
- 5) Which of the follow in meat substitute(s) is/are good sources of iron?
  - a) Eggs
  - b) Cooked bean
  - c) Seeds/nuts
- 6) Circle food source of vitamin C
  - a) Paw-paw and Strawberries
  - b) Oranges and Mango
  - c) Banana and Watermelon
- 7) Which of the following drink(s) is/are a good source of vitamin C?
  - a) Lemon juice
  - b) Tangerine juice
  - c) Cocoa cola
- 8) Which of the following vegetables are high sources of vitamin C?
  - a) Cabbage
  - b) Cowpeas leaves
  - c) Tomato
- 9) What are other ways in which you can get iron?
  - a) Cook foods in cast iron pots
  - b) Adding meats to foods.
  - c) Drinking a four cups of milk daily

- 10) Which of the follow meals is a good example of iron and vitamin C foods?
- a) Chicken, rich, spinach and oranges
  - b) Potatoes and cassava leaves
  - c) Bread and groundnut pudding

### Appendix E 3

#### Pretest/Posttest Questionnaire for Patient and Community Healthcare Workers: Kiswahili

Translated (Kiswahili) questions that were used to assess the knowledge of the patients and community healthcare workers on indigenous Kenyan foods rich in heme and non-heme iron as well as vitamin C. Participants were asked to circle the correct answer(s).

Vyakula Vyenye madini ya chuma na vitamini C kwa wingi

Sahihisha Jibu mwafaka.

1. Ni Vyakula gani kati ya haya vyenye madini ya chuma?
  - a) Samaki na kuku
  - b) Nyama nyekundu na maini
  - c) Jibu (a) na (b)
2. Chagua mboga moja kati ya haya yenye madini mengi ya chuma.
  - a) Spinachi
  - b) Karoti
  - c) Mihogo
3. Chagua mmoja kati ya nafaka hizi yenye madini mengi ya chuma?
  - a) Mtama
  - b) Ngano
  - c) Mkate
4. Ni yapi kati ya vyakula hivi ambavyo husaidia usharabu wa madini ya chuma?
  - a) Kabichi
  - b) Nanasi
  - c) Maembe
5. Chagua kati ya vyakula hivi ni gani yenye madini mengi ya chuma?
  - a) mayai
  - b) maharagwe
  - c) njugu
6. Chagua vyakula kati ya haya vyenye vitamini C kwa wingi
  - a) Papai na mapera
  - b) Machungwa na maembe
  - c) Mandizi na tikiti maji (water melon)
7. Chagua kati ya vinywaji hivi chenye vitamini C kwa wingi?
  - a) Maji ya Ndimu
  - b) Maji machungwa
  - c) Cocacola
8. Chagua kati ya mboga-mboga hizi ni yapi yenye Vitamini C kwa wingi?
  - a) Kabichi
  - b) Kunde

- c) Nyanya
- 9. Mifano ya mbinu ambazo unaweza tumia ili uweze kupata madini ya chuma
  - a) Utayarishaji na upishi bora wa vyakula na hasa mboga-mboga za kijani
  - b) Kula milo yenye nyama nyingi
  - c) Kunywa maziwa kila siku
- 10. Mfano wa mlo wenye vyakula vyenye madini ya chuma na vitamini C kwa wingi ni?
  - a) Kitoweo cha kuku, wali, na spinachi ukimalizia na machungwa
  - b) Viazi na mihogo
  - c) Tosti bandika

## Appendix F 1

### Pamphlet on Iron Deficiency Anemia: English

#### LET'S FIGHT IRON DEFICIENCY WITH VITAMIN C AND IRON-RICH FOOD SOURCES

##### What is Iron Deficiency Anemia?

Iron deficiency anemia is when iron levels are lower than normal in your body.

##### Symptoms of iron deficiency anemia

- Pale skin color
- Feeling weak & tired
- Unable to breath well
- Brittle nails
- Decreased appetite
- Get sick often
- Frontal headaches
- Crankiness
- Blue tingle & whites of eyes

##### What are the causes of anemia?

- Not having enough blood
- Diseases like malaria and sickle cell
- If women lose a lot of blood during birth
- Poor nutrition

##### How can I prevent anemia?

- Eat foods that are rich in iron 2-3 times a day
- Eat foods that are rich in vitamin C
- Apply proper cooking techniques

##### Animal foods high in iron

- Chicken, beef or liver, fish, pork.

##### Plant foods high in iron

Beans, green gram, rice, millet bulrush, cowpeas, water lily seeds, groundnuts, soybeans apoth, amaranth seed, sorghum, pawpaw, odielo, leafy greens (spinach, sweet potato & cassava leaves), Cabbage, beetroots, Omena, Jaggery Cane, Millet Finger, Cumin seed, Coconut meal.

*Keep in mind that your meal should include iron and vitamin C food sources.*

*Example: Stewed chicken, steamed rice and steamed spinach, plus an orange make up a meal rich in iron and vitamin C*

##### Foods with High Iron Content

*Animal foods high in iron (85 grams = 1serving)*



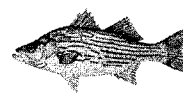
Liver



Beef



Chicken



Fish

##### Plant foods high in iron



Groundnuts



Beans



Spinach



Green peas

Vitamin C helps your body use iron. Eat foods high in Vitamin C in combination with iron-rich foods

##### Foods high in Vitamin C



Potatoes



Oranges



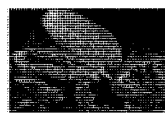
Guavas



Pineapple



Cabbage



Pawpaw

##### Tips to get more iron

- Cook foods in cast iron pots, or pans
- Soak dry beans for several hours in cold water before you cook them. Pour off the water and use new water to cook the beans. Cook beans with tomatoes

**Keep in mind at mealtime that:**

**Iron foods + Vitamin C foods**

=



## Adding Vegetables to Stew

Vegetables contain many vitamins and minerals that can be easily lost during cooking. Many are heat sensitive and may be destroyed by either high heat or prolonged cooking. Adding vegetable to you stews 2-3 minutes just before serving:

- Add vegetables to stews 2-3 minutes before serving.
- Add vegetables to stews 2-3 minutes before serving.
- Add vegetables to stews 2-3 minutes before serving.

### **Consider These Tips when adding Vegetables to stews**

- Add 2-3 minutes close to serving time as possible to avoid loss of nutrients.
- Vegetables should be firm to the bite, pleasantly crunchy, crispy-tender (basically, do not overcook)
- Soft vegetables, like greens, cook quickly while hard and starchy vegetables, like potatoes, cook longer.
- Raw vegetables should be thoroughly cleaned and crisply cut in uniform pieces before adding to stew to allow for even cooking.

### **References:**

Mizer, D.A., Poeter, M., Sonnier, B., et al., (2000). *Vegetable, Grains, and Pasta*. (3<sup>rd</sup> ed.), Food preparation for the professional (pp. 245-253). John Wiley & Sons, Inc. Canada

Battling Iron Deficiency Anemia. (2003). Retrieved August 13, 2005, from, <http://www.who.int/nut/ida.htm>.

Created by Patricia Kakunted



## Appendix F 2

### Pamphlet on Iron Deficiency Anemia: Kiswahili

**TUZIUE UPUNGUFU WA MADINI YA CHUMA KWA KULA VYALULA VYENYE MADINI CHUMA NA VITAMINI C KWA WINGI!**

#### Vyakula vyenye madini mengi ya chuma

*Vyakula vinavyotokana na wanyama (85 grams = kipimo kimoja)*

#### Upungufu wa wekundu wa damu ni nini?

Upungufu wa wekundu wa damu ni tatizo ambalo husababishwa na ukosefu wa madini ya chuma mwilini.

#### Dalili za Upungufu wa wekundu wa damu

- Uchovu na ulegevu mwilini
- Mapigo ya moyo kuongezeka
- Kupumua kwa shida
- Vidole kufa ganzi
- Weupe usio wa kawaida kwenye macho, midomo, kucha, viganja, ufizi, ulimi na hata ngozi
- Kizunguzungu
- Hamu ya kula udongo kwa wanawake wajawazito
- Masikio kuvuma

#### Upungufu wa wekundu wa damu husababishwa na nini?

- Upungufu wa damu mwilini
- Maradhi mbalimbali hasa malaria, Ukimwi, saratani, vidonda vya tumbo na minyoo kama safura na kichocho
- Uzazi wa karibu
- Utapiamlo

#### Mbinu za kuzuia tatizo la upungufu wa wekundu wa damu

- Kuzingatia kula vyakula vya kutosha vyenye madini ya chuma
- Kula vyakula vya kutosha vyenye vitamini C
- Kuzingatia utayarishaji bora wa vyakula na hasa mboga-mboga za kijani

#### Vyakula vinavyotokana na wanyama vyenye madini ya chuma kwa wingi

- Kuku, maini, nyama nyekundu, samaki, dagaa,

#### Mboga za kijani, nafaka na aina za maharagwe zenye madini ya chuma kwa wingi

maharagwe, ndengu, mchele, wimbi, kunde, aina zote za viazi, mboga, mtama, mnazi, bitiruti,



Maini



Nyama ya Ngombe



Kuku

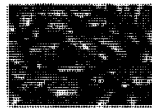


Samaki

#### Vyakula vya mikunde, na Mboga-mboga venye madini ya chuma kwa wingi



Njugu karanga



maharagwe

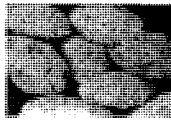


Spinachi



Njegere

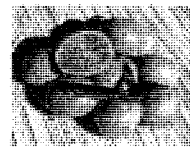
Vitamini C husaidia usharabu wa madini ya chuma. Ni muhimu kula vyakula vyenye vitamini C kwa wingi pamoja na vyakula vyenye madini ya chuma kwa wingi.



Viazi



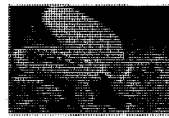
Machungwa



Mapera



Kabichi



Papai



Nanasi

#### Kumbuka:

Vyakula vyenye madini ya chuma

+

Vyakula vyenye vitamini C =



*Kumbuka ya kwamba ni muhimu kula vyakula vyenye madini ya chuma pamoja na vyakula vyenye vitamini C kwa wingi.*

**Kwa mfano:** Kitoweo cha kuku na wali, pamoja na spinachi iliyoipikwa kwa mvuke, na kumaliza na machungwa

Created by Patricia Kakunted

## Upishi wa Mboga za Kijani

Mboga za kijani huwa na madini na vitamini vingi, ambayo hupotezwa kwa urahisi ikiwa utayarishaji wa chakula sio bora. Mboga za kijani hupika kwa mvuke kwa sababu:

- \* Hupoteza madini ya chuma.
- \* Hupoteza vitamini B.
- \* Hupoteza vitamini C.
- \* Hupoteza vitamini E.

### Mbinu za upishi wa mboga za kijani

- Pika kwa mvuke kwa muda mfupi ilikuhi fadhi virutubishi
- Wakati unapopika mboga hizi hakikisha ya kwamba chombo cha kupikia hakijafutikwa.
- Pika mboga hizi mwisho ilikusiwepo na haja ya kuzipasha moto tena wakati wa kula

### References:

Mizer, D.A., Poeter, M., Sonnier, B., et al., (2000). Vegetable, Grains, and Pasta.(3<sup>rd</sup> ed.), Food preparation for the professional (pp. 245-253). John Wiley & Sons, Inc. Canada

Battling Iron Deficiency Anemia. (2003). Retrieved August 13, 2005, from, <http://www.who.int/nut/ida.htm>.

Appendix G  
Grading criteria for pretest and posttest questionnaires.

Pre-test score (A)	Post-test score (B)	Total score (A + B)
0	0	0
0	2	2
1	0	1
1	2	3

0/0 = Participants did not get the correct answer in both pre/posttest.

0/2 = Participants did not get the correct answer pretest but got it correct posttest.

1/0 = Participants got the correct answer pretest but wrong the posttest.

1/2 = Participants got the correct answer pre/posttest.

0 = Sum of total score in pre/post test indicating no change (no improvement) in knowledge.

1 = Sum of total score in pre/post test indicating no change (no improvement) in knowledge.

2 = Sum of total score in pre/post test indicating a change (improvement) in knowledge.

3 = Sum of total score in pre/post test indicating pre-existing knowledge.

The questions used on the questionnaires (Appendixes E1-3) were graded for frequency analysis. All participants were given points if they identified the right answers to the questions. There were 4 different possible ways to grade the 10 questions. If participants did not identify the correct answer in the pre-test, a 0 was given. After the intervention, if they still did not identify the correct answer, another 0 was marked against them indicating that they did not gain any knowledge, even after the intervention and given a total score of 0. The second possible way was, if they did not get the correct answer during the pre-test, they were given a 0 but if after the intervention they had a change in knowledge, they were given the number 2 indicating a gain in knowledge and given a total score of 2 points. The third possible way was, if they identified the right answer in the pre-test, they were given the number 1, but if they failed to identify the

correct answer when the post-test was administered, they were given a 0 with a total score of only 1. The fourth possible way was that participants were given the number 1 in the pre-test if they got it correct and if they got it correct in the post-test, they were given the number 2 indicating they maintained the knowledge and therefore were given a total score of 3 points. The total score was the most important number with 0 and 1 indicating no change in knowledge after the intervention. The number 2 indicated a change in knowledge due to the intervention while a total score of 3 indicated pre-existing knowledge.

## Appendix H

### Additional Data

Frequencies of participants, based on change in knowledge, on the ability to select indigenous source of vegetable high in iron.

<b>Variables</b>	<b>NC<sup>1</sup></b>	<b>C<sup>2</sup></b>	<b>PE<sup>3</sup></b>
<b><i>Education</i></b>			
No education	0	2	0
Primary school	5	6	10
Secondary school	3	3	24
University	4	7	12
Other	1	0	0
<b><i>Group</i></b>			
Patients	8	4	12
Healthcare workers	1	7	23
Nurses	4	7	11
<b><i>Site</i></b>			
Voi	3	6	11
Mombassa	2	3	13
Nairobi	8	9	22
<b><i>Gender</i></b>			
Female	8	13	33
Male	5	5	8

<sup>1</sup>NC: No change in knowledge before and after nutrition intervention.

<sup>2</sup>C: Change in knowledge after nutrition intervention.

<sup>3</sup>PE: Pre-existing knowledge before and after nutrition intervention.

Frequencies of participants, based on change in knowledge, on the ability to identify a grain with high iron contain.

<b>Variables</b>	<b>NC<sup>1</sup></b>	<b>C<sup>2</sup></b>	<b>PE<sup>3</sup></b>
<b><i>Education</i></b>			
No education	0	1	1
Primary school	9	2	10
Secondary school	6	5	18
University	2	0	21
Other	1	0	0
<b><i>Group</i></b>			
Patients	10	1	12
Healthcare workers	7	6	18
Nurses	1	1	20
<b><i>Site</i></b>			
Voi	6	4	10
Mombassa	8	1	9
Nairobi	4	3	31
<b><i>Gender</i></b>			
Female	12	5	37
Male	4	2	11

<sup>1</sup>NC: No change in knowledge before and after nutrition intervention.

<sup>2</sup>C: Change in knowledge after nutrition intervention.

<sup>3</sup>PE: Pre-existing knowledge before and after nutrition intervention.

Frequencies of participants, based on change in knowledge, on the ability to identify foods that enhance iron absorption.

<b>Variables</b>	<b>NC<sup>1</sup></b>	<b>C<sup>2</sup></b>	<b>PE<sup>3</sup></b>
<b><i>Education</i></b>			
No education	1	0	1
Primary school	15	5	1
Secondary school	22	5	3
University	2	2	19
Other	0	0	1
<b><i>Group</i></b>			
Patients	16	5	3
Healthcare workers	23	6	2
Nurses	1	1	20
<b><i>Site</i></b>			
Voi	14	4	2
Mombassa	12	4	2
Nairobi	14	4	21
<b><i>Gender</i></b>			
Female	28	8	18
Male	8	3	7

<sup>1</sup>NC: No change in knowledge before and after nutrition intervention.

<sup>2</sup>C: Change in knowledge after nutrition intervention.

<sup>3</sup>PE: Pre-existing knowledge before and after nutrition intervention.

Frequencies of participants, based on change in knowledge, on the ability to identify plant food sources of iron.

<b>Variables</b>	<b>NC<sup>1</sup></b>	<b>C<sup>2</sup></b>	<b>PE<sup>3</sup></b>
<b><i>Education</i></b>			
No education	2	0	0
Primary school	12	2	7
Secondary school	20	0	9
University	10	10	3
Other	1	0	0
<b><i>Group</i></b>			
Patients	17	1	5
Healthcare workers	18	2	11
Nurses	10	9	3
<b><i>Site</i></b>			
Voi	13	1	6
Mombassa	11	2	5
Nairobi	21	9	8
<b><i>Gender</i></b>			
Female	32	11	11
Male	9	1	7

<sup>1</sup>NC: No change in knowledge before and after nutrition intervention.

<sup>2</sup>C: Change in knowledge after nutrition intervention.

<sup>3</sup>PE: Pre-existing knowledge before and after nutrition intervention.



Frequencies of participant based on change in knowledge, on the ability to identify indigenous drinks rich in vitamin C.

<b>Variables</b>	<b>NC<sup>1</sup></b>	<b>C<sup>2</sup></b>	<b>PE<sup>3</sup></b>
<b><i>Education</i></b>			
No education	0	1	1
Primary school	2	1	18
Secondary school	2	2	25
University	2	1	20
Other	0	0	1
<b><i>Group</i></b>			
Patients	3	2	18
Healthcare workers	1	2	28
Nurses	2	1	19
<b><i>Site</i></b>			
Voi	1	3	16
Mombassa	2	0	16
Nairobi	3	2	33
<b><i>Sex</i></b>			
Female	3	5	46
Male	2	0	15

<sup>1</sup>NC: No change in knowledge before and after nutrition intervention.

<sup>2</sup>C: Change in knowledge after nutrition intervention.

<sup>3</sup>PE: Pre-existing knowledge before and after nutrition intervention.

Frequencies of participants, based on change in knowledge, on the ability to identify indigenous vegetables with high vitamin C content.

<b>Variables</b>	<b>NC<sup>1</sup></b>	<b>C<sup>2</sup></b>	<b>PE<sup>3</sup></b>
<b><i>Education</i></b>			
No education	1	1	0
Primary school	19	0	2
Secondary school	24	5	1
University	3	1	19
Other	0	0	1
<b><i>Group</i></b>			
Patients	19	2	3
Healthcare workers	25	5	1
Nurses	3	0	19
<b><i>Site</i></b>			
Voi	16	4	0
Mombassa	14	1	3
Nairobi	17	2	20
<b><i>Sex</i></b>			
Female	33	5	16
Male	9	2	7

<sup>1</sup>NC: No change in knowledge before and after nutrition intervention.

<sup>2</sup>C: Change in knowledge after nutrition intervention.

<sup>3</sup>PE: Pre-existing knowledge before and after nutrition intervention.

Frequencies of participants, based on change in knowledge, on the ability to identify a meal with iron and vitamin C.

<b>Variables</b>	<b>NC<sup>1</sup></b>	<b>C<sup>2</sup></b>	<b>PE<sup>3</sup></b>
<b><i>Education</i></b>			
No education	1	0	1
Primary school	5	3	13
Secondary school	6	2	21
University	1	13	9
Other	0	0	1
<b><i>Group</i></b>			
Patients	5	3	15
Healthcare workers	6	2	23
Nurses	2	13	7
<b><i>Site</i></b>			
Voi	5	3	12
Mombassa	1	2	15
Nairobi	7	13	18
<b><i>Sex</i></b>			
Female	12	14	28
Male	1	3	13

<sup>1</sup>NC: No change in knowledge before and after nutrition intervention.

<sup>2</sup> C: Change in knowledge after nutrition intervention.

<sup>3</sup> PE: Pre-existing knowledge before and after nutrition intervention.

## Appendix I

### List of some Kenyan Indigenous Foods Rich in Iron and Vitamin C

Iron-Rich Foods	Vitamin C rich foods
Cow meat	Potatoes
Organ meat	Oranges/orange juice
Beef Liver	Guavas
Antelope	Pineapple/pineapple juice
Chicken	Passion fruit/passion fruit Juice
Duck	Lemon
Goat meat	Lime
Lamb Meat	Tomatoes
Pork	Cabbage
Rabbit meat	Pawpaw (Papaya)
Fish	Mangoes/mango juice
Eggs	Broccoli
Millet bulnish	Tangerines
<b>Plants food sources of iron</b>	Grapes fruit
Beans	Pepper
Water lily seeds	Strawberries
Groundnuts	
Amaranth Seed	
Soybeans apoth	
Beetroots	
Omena	
Millet Finger	
Cumin Seed	
Odielo	
Leafy greens (spinach, sweet potato & cassava leaves)	
Green gram	
Sorghum	
Jaggery cane	
Lettuce	